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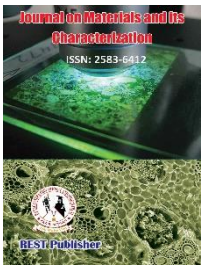


# A comparison analysis using the MCDM technique using Hydrogel-Based Drug Delivery Nanoparticles as Traditional Therapeutic Approaches to Cancer Tumors

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**Abstract:** *Uncontrolled division of abnormal cells in a particular region of the body leads to cancer, a disease that worsens or kills off cells. This could result in the recipient carrier dying. The majority of cancer patient deaths have been associated with the systematic administration of therapeutic agents (chemotherapy) and other conventional methods, which is the preferred treatment approach for cancer therapy. The mortality of this therapy is associated with side effects, off-target accumulation, toxicity, and rapid renal and hepatic clearance. Scientists have recently studied tumor site targeting and better retention of constant drug delivery to tumors in order to minimize side effects and toxicity-related challenges. Ingenious drug delivery methods for cancer therapy have been developed by scientists and researchers using water-containing polymers known as hydrogels. These drug transport systems' network-like structure and biological tissue-like consistency allow the drugs loaded into them to remain in a relatively stable condition. This study compares hydrogel-based drug delivery systems with other conventional cancer therapy approaches using the Technique for Order of Preference by Similarity to Ideal Solution (TOPSIS) way of multicriteria decision making (MCDM). Based on specific criteria with given importance weights, a comparison is made. This study shows that by offering additional alternatives and criteria with availability and significance weights, the approach taken can be made more helpful and helpful in offering remedies to healthcare decision-makers facing ambiguous problems. Individual cancer sufferers' specific medical conditions.*

**Key words:** *Chemotherapy, hydrogels drugs, Radiation therapy.*

## 1. INTRODUCTION

The main risk factors for cancers that can be avoided include smoking, excessive ultraviolet, or UV, ray exposure from the sun or tanning beds, being overweight or obese, and drinking too much alcohol. Cancer is brought on by cells that grow out of control and spread to nearby organs. Cancer is primarily brought on by DNA changes. The majority of DNA changes that result in cancer occur in regions of DNA known as genes. These adjustments are also referred to as genetic changes. Basic facts and figures about some of the most prevalent diseases in the US are provided by the CDC. Smoking, genetic mutations, and exposure to specific substances are risk factors for bladder cancer, as are colorectal cancer, kidney cancer, lymphoma, ovarian cancer, and thyroid cancer. There are four primary cancer types: Leukemia is a blood cancer, while lymphomas begin in the lymphatic system and sarcomas begin in the tissues that support and connect the body. Carcinomas begin in the epidermis or the tissue that covers the surface of internal organs and glands. The NCI's Surveillance, Epidemiology and End Results (SEER) program's most recent statistical statistics show that the average age of a cancer diagnosis is 66 years old. In other words, half of all instances of cancer affect people under this age, and the other half affect people over this age. Hydrogels are a particularly alluring class of drug delivery systems in many medical fields, such as pain management, immunology, oncology, wound healing, and cardiology. A cross-linked polymer network and a significant quantity of water make up hydrogels. a method of treating symptoms and illnesses in which medical doctors and other healthcare professionals (such as nurses, pharmacists, and therapists) use medication, radiation, or surgery. Allopathic medicine is also referred to as biomedicine, mainstream, orthodox, and western medicine. Cancer is a severe cause of death that develops when abnormal cells in one area of the body divide out of control, Apoptosis, which results in cell death or damage, destroys the host carrier [1]. Cancer is known to be the main

cause of fatalities worldwide and is the second-deadliest disease. 10 million fatalities worldwide in 2020 were due to cancer [2]. When compared to the quickly expanding global population, the death rate has essentially decreased over the past few years. In 2018, there were 9.6 million reported deaths, up from 7.6 million in 2007 [2]. Given the slow rate of cancer death cases per year and the rapid growth of the global population, it is reasonable to infer that cancer death cases are rising slowly. This is only possible because scientists and researchers have enhanced treatment techniques recently [2]. Chemotherapy, radiation, surgery, and immunotherapy are the favored treatment modalities, and their systematic administration has been linked to the majority of cancer patient mortality. These traditional therapeutic modalities have a reputation for causing adverse reactions, rapid renal and hepatic clearance, toxicity, and off-target accumulation [3]. In order to address issues with side effects and toxicity, researchers have looked into drug delivery methods that can target tumor sites and keep therapeutic agents there [4]. The target selectivity and delivery efficiency of anticancer drug delivery devices have been improved [5]. The most dependable and effective method of administering therapeutics is thought to be localized drug delivery; However, due to issues like poor biodegradability, high immunogenicity, poor drug retention capacity, and failure to sustain release, this technique encounters many challenges. anti-tumor medicines at the affected site. Researchers and scientists have successfully used hydrogels to circumvent the drawbacks of inefficient drug delivery systems and problematic localized drug administering systems [3]. Hydrogels have proven to be highly dependable and biocompatible materials that allow innovative design to simultaneously offer smart sensing and treatment [7]. Smart hydrogels can respond to environmental signals like temperature, pH, light, and ultrasound to create a controlled and sustained drug delivery environment that greatly improves the efficiency and convenience of the release of antitumor agents [8]. The drugs loaded in this hydrogel-based drug delivery system are relatively durable because of their network-like structure and biological tissue-like stability [8]–[10]. This study contrasts hydrogel-based drug delivery systems with other conventional cancer therapy modalities using one of the analytical multi-criteria decision-making (MCDM) techniques, specifically TOPSIS. The previous research, which compared various cancer treatment modalities using a similar methodology, was improved by this study. In contrast to other conventional cancer therapy methods, the modification of evaluation, contrast, and rating factors as well as the addition of a hydrogel-based drug delivery system. The use alone, treatment cost, adverse effects, survival rate, tumor necrosis rate, dependability, rate of pain relief, recovery time, complications while using, retention rate, and treatment duration are used to evaluate the two treatments. Each of the treatment modalities examined in this study is described in depth below.

## 2. SYSTEMS FOR DRUG DELIVERY USING HYDROGEL

A cross-linked, hydrophilic, three-dimensional polymeric network called a hydrogel has the ability to keep a sizable area inside of its structure while minimizing swelling [9]. They have the ability to be developed into drug delivery systems and are never water soluble. One of their most important properties is that hydrogels grow when there is water present and shrink when there is none. Because they react to environmental cues like temperature and pH changes by altering their chemical or physical conduct, hydrogels that are are intelligent systems that allow for the controlled and long-lasting release of encapsulated drugs [8]–[10]. the use of a variety of drugs taken from biological sources, such as various bacteria and viruses, has been the sole stay for cancer treatment over the past few decades. These bio-based medications, among other things, degrade quickly, making them useless when administered into the body without no reaching the affected region [5]. Therefore, it is crucial to transport drugs effectively and release them at their intended sites. Drugs released from hydrogels can be controlled and positioned at the target site because hydrogels continuously swell in response to specific cues or minute changes in environmental factors like temperature or pH. Hydrogels can be tailored using the manufactured polymer polyethylene glycol, also known as diglycidyl ether, and the sulfur-containing organic compound cystamine. It also swells and contracts in response to the ambient temperature and pH. Due to glycolysis in tumor cells, the pH of the tumor milieu varies between 5.5 and 6.5 [5][10]. a treatment that most medical professionals use and is generally accepted. This is distinct from less popular alternative or complementary treatments. Chemotherapy, radiation treatment, and surgery are a few examples of traditional cancer therapies. Hydrogels come in two different varieties: manufactured and natural. It is well known that both natural and manufactured polymers work well as drug-delivery polymers for tissue targeting [12]–[14]. To reach the targeted tumor tissue, the polymeric nanoparticles remain in the bloodstream for a long period without being eliminated. Non-toxicity, biocompatibility, and biodegradability should all be present [15]. Researchers' interest has been piqued by natural polymers like starch, chitosan, alginate, hyaluronic acid, silk, gelatin, collagen, fibrin, and glycosaminoglycans because of their prevalence, minimal toxicity, biological compatibility, and ability to degrade [15]–[17]. Among the natural polysaccharides, cellulose is one of the most commonly used as a hydrogel due to its extraordinary biocompatibility and ability to degrade [18]. Another naturally occurring polysaccharide produced from chitin is

chitosan. When employed as a carrier, chitosan exhibits increased solubility in water. Due to its adhesive cationic nature, it can hold medications at the tumor site, allowing for a controlled drug delivery process. It is well recognized for its availability, adjustable biodegradability, and controllable non-immunogenicity [19], [20].

## 3. MECHANISM AND CONTROL SURFACES

Well-known cancer treatment methods include conventional cancer therapies. They consist of things like hydrotherapy, radiation treatment, surgery, chemotherapy, and more. Overview of conventional cancer therapy methods is given, along with a discussion of their advantages and disadvantages.

**Chemotherapy:** Anticancer medications are used in chemotherapy to start tumor apoptosis. These anticancer medications can be administered systemically or orally [3]. They circulate through the circulation to the locations of cancer cells where they start a high rate of tumor necrosis [1]. Chemotherapy frequently involves off-targeting, which results in the death of nearby healthy cells. This can result in a variety of side effects, including diarrhea, liver or kidney failure, hair loss, nausea, vomiting, fatigue, mouth sores, rashes on the hands or feet, and mouth sores. Overdosage has been linked to these adverse effects [13].

**Radiation therapy:** In order to eliminate cancer cells from the body, an X-ray radiation is used [23]. It functions on the basis of the electrical ionization principle, in which charged particles in the body transmit energy from the rays to the body's cells through the action of radiation. This kills cancer cells or modifies the genetics of cells to start cell necrosis. This method relies on the process of mutations in genes that harm DNA and thereby prevent cell growth, killing cancer cells [1]. In radiation treatment, the radiation kills cancer cells, causes bone ossification, decreases osteoclast activity, and results in tumor necrosis. Damage to healthy tissues and normal cells occurs needlessly. A lifespan can be lost due to damage to cells or tissues that cannot be repaired. Faecal leakage, exhaustion, erectile failure in men, vaginal itchiness in women, fibrosis, scarring, neurological disorders, etc. are a few of these adverse effects. Targeting the tumor spot and getting radiation beams to some tumors' locations are challenges as well. In the case of bone malignancy, chondrosarcomas are regarded as radiolucent tumors [24].

**Surgery:** Following the administration of analgesics, surgery is the manual removal of cancerous tumors through the skin using sterile incisional instruments [1], [3]. Surgery has a good rate of local tumor control [29]. Cuts through the epidermis, muscles, and sometimes bones are required during surgery. These incisions can be excruciating and can result in bleeding, infection, and blood clots. Furthermore, a few cancer cells may stay in the affected area and cause cancer to recur [12].

**Hydrogel-based therapy:** The most cutting-edge, precise, and safe anticancer medication delivery method is this one. Hydrogels enable you to give targeted doses only to affected sites, in contrast to traditional cancer therapies that target both cancer and healthy cells [7]. The use of hydrogels in conjunction with chemotherapy, surgery, or radiation treatment is possible even though they cannot completely cover large tumors, particularly those that are larger than 10 cm [14].

**Hydron therapy:** It is a specific type of radiotherapy that includes treating cancer with a beam (protons, neutrons, and other ions) [1]. Compared to radiation therapy, hydron therapy is an extremely tumor-targeted technique for controlling tumors. Although it is more expensive and only effective against certain kinds of cancer, it has fewer side effects.

**Immunotherapy:** In order to combat cancer or tumor cells in the body, the immune system must be strengthened or stimulated [4]. Immune-enhancing vaccines are used to activate or stimulate the immune system in order to promote an effective immune response against tumors [12]. These vaccines may use monoclonal antibodies, therapeutic agents (drugs), cytokines, lymphocytes, or other biological immune modifiers. It offers permanent tumor cell control with no possibility of return. Compared to other traditional treatments for cancer cells, it is more frequently addressed. Due to this, the immune system may overreact or be misdirected, which could result in an immediate assault on other organs or deadly allergic reactions [14].

Pain Relief Rate: Cancer frequently comes with uncomfortable pain. The decision-maker needs to be able to reduce suffering the most. All available treatment methods reduce pain, but the ideal method for doing so is necessary. Tumor Necrotic Rate: Tumor necrosis is a possible side effect of all cancer treatment methods. The demise of tumors is called tumor necrosis. (tumor destruction). To relieve discomfort and lower the chance of slow tumor progression, maximum tumor necrosis is necessary. As a consequence, tumors are completely removed and are less likely to return. Reliability: The degree to which a specific therapy option can be relied upon. Reliability is a crucial factor to consider when evaluating different treatment options. The study's options have been compared using a reliability criterion value of 0.92. Recovery Period: This refers to the anticipated time frame for a patient's recovery following any type of therapy strategy. Alternatives that allow patients to recuperate quickly are viewed favorably. Use alone: Combinations of traditional cancer therapy techniques are

frequently used. Surgery should only be used as a last option if chemotherapy has failed and tumor metastasis (spread) and necrosis rates are low. Because of this, treating cancer diseases has become a costly, drawn-out procedure with significant side effects. It is better, less demanding, and has fewer side effects to use a therapy approach that can be used independently. Treatment-related complications: The methods used to treat cancerous masses are frequently difficult to administer. For our comparison, a treatment choice is deemed preferable if it has a high target rate, can remove tumors fast, and is simple to apply. Side effects: Depending on the therapy strategy, the side effects of cancer treatments, especially traditional ones, can range from minor to serious. On the other hand, any possible side effects have been significantly reduced by contemporary cancer tumor treatments. Treatment costs: A low-cost treatment choice is deemed to be cost-effective and benefits the patient. Treatment Period: The period of time required to completely eradicate cancer.

## 4. MATERIAL AND METHODS

The most effective cancer tumor therapy options are consistently assessed, assessed, and compared based on thorough experiments and theoretical assessments. Artificial intelligence techniques are now being used to evaluate diagnostic and therapeutic modalities in order to determine which is the most effective [53]. Using MCDM methodologies, several studies have compared, ranked, and assessed different approaches to the detection and treatment of various cancer types. Using the MCDM technique known as TOPSIS, no research has yet compared hydrogel-based drug delivery systems with traditional cancer treatment strategies. The TOPSIS methodology is used in this research to assess, rank, and compare various cancer treatment modalities, including hydrogel-based drug delivery nanoparticles. This technique, which compares diagnostic and therapeutic modalities for cancerous tumors, has only been applied in a very small number of studies, making it exclusive to the present investigation.

**TABLE 1.** Evaluation parameter

| | |
|---|---|
| C1 | Pain relief rate |
| C2 | Use in isolation |
| C3 | Survival rate |
| C4 | Tumor necrotic rate |
| C5 | Reliability |
| C6 | Side effects (after effect) |
| C7 | Cost of treatment |
| C8 | Recovery period |
| C9 | Complications during use |
| C10 | Treatment time |

The evaluation parameters for pain relief, use in isolation, survival rates, tumor necrosis rates, dependability, side effects (after effects), cost of treatment, recovery time, complications during use, and therapy duration are shown in Table 1.

**TABLE 2.** Assessment of Conventional cancer therapies

| | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemotherapy | 31.08 | 69.43 | 82.73 | 0.00 | 51.34 | 19.43 | 17.65 | 75.43 | 21.34 | 75.49 |
| Radiation therapy | 29.12 | 78.34 | 79.18 | 0.00 | 91.34 | 45.36 | 48.31 | 61.34 | 82.97 | 27.30 |
| Surgery | 72.34 | 22.31 | 53.24 | 54.12 | 93.46 | 75.76 | 66.21 | 44.70 | 19.00 | 12.42 |
| Hydrogel-based therapy | 84.35 | 28.34 | 75.15 | 47.15 | 89.34 | 69.58 | 64.57 | 21.98 | 28.34 | 17.59 |
| Hydron therapy | 42.13 | 51.34 | 92.10 | 58.36 | 74.36 | 78.36 | 71.45 | 32.45 | 54.37 | 18.89 |
| Immunotherapy | 22.13 | 55.47 | 49.83 | 0.00 | 54.12 | 51.34 | 45.32 | 54.37 | 26.98 | 68.42 |
| | B | B | B | B | B | NB | NB | NB | NB | NB |

According to specialists, the conventional cancer therapies are evaluated in Table 1. Using C1, C2, C3, C4, C5, C6, C7, C8, C9, and C10, conventional cancer treatments are assessed. B is maximum value for better, and NB is minimum value for better.

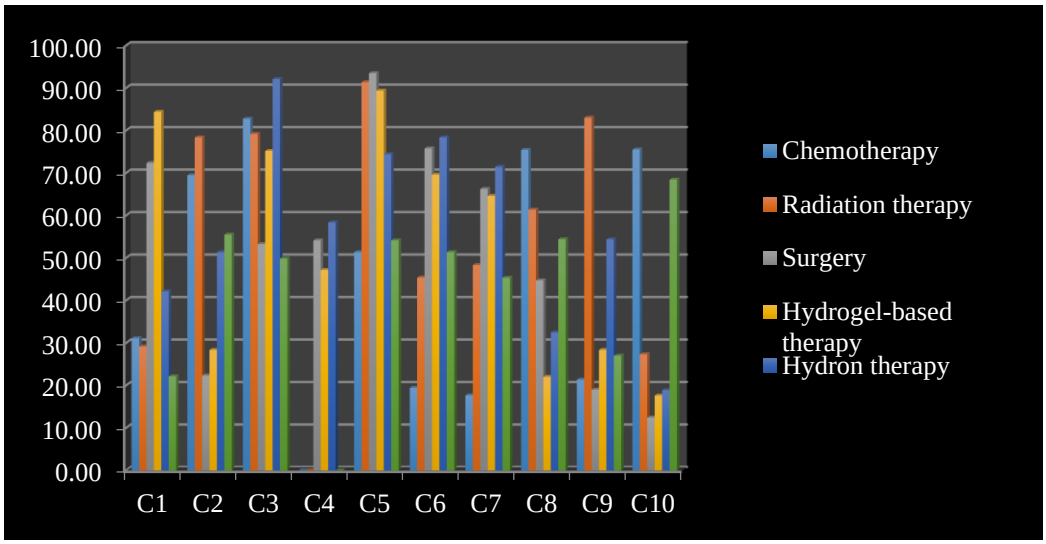


**FIGURE 1.** Assessment of Conventional cancer therapies

An expert's assessment of conventional cancer treatments is depicted graphically in Figure 1. Using C1, C2, C3, C4, C5, C6, C7, C8, C9, and C10, conventional cancer treatments are assessed.

**TABLE 3.** Normalized Data

| | C1 | C2 | C3 | C4 | C5 | C6 | C7 | C8 | C9 | C10 |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemotherapy | 0.242 | 0.517 | 0.458 | 0.000 | 0.270 | 0.131 | 0.130 | 0.597 | 0.193 | 0.690 |
| Radiation therapy | 0.227 | 0.584 | 0.438 | 0.000 | 0.480 | 0.307 | 0.356 | 0.485 | 0.751 | 0.249 |
| Surgery | 0.564 | 0.166 | 0.295 | 0.585 | 0.491 | 0.513 | 0.488 | 0.354 | 0.172 | 0.113 |
| Hydrogel-based therapy | 0.658 | 0.211 | 0.416 | 0.509 | 0.469 | 0.471 | 0.476 | 0.174 | 0.256 | 0.160 |
| Hydron therapy | 0.328 | 0.383 | 0.510 | 0.630 | 0.391 | 0.530 | 0.527 | 0.257 | 0.492 | 0.172 |
| Immunotherapy | 0.172 | 0.413 | 0.276 | 0.000 | 0.284 | 0.347 | 0.334 | 0.430 | 0.244 | 0.626 |

The normalized matrix of the Ratings of the performance of the selection of the Hydrogel-Based Drug Delivery Systems is displayed in Table 2 above seeing figure 2.

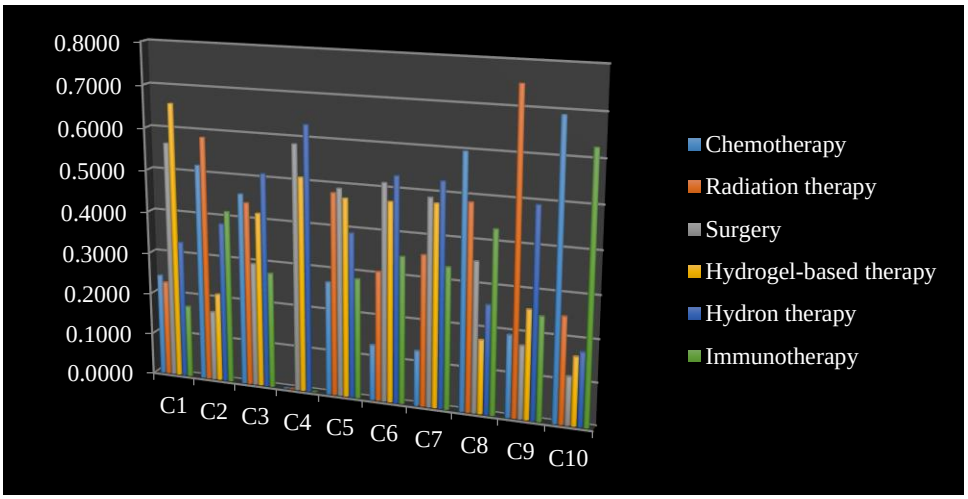


**FIGURE 2.** Normalized Data

**TABLE 3.** Weight

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemotherapy | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Radiation therapy | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Surgery | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Hydrogel-based therapy | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Hydron therapy | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |
| Immunotherapy | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 | 0.10 |

The preferred weight for the evaluation parameters is shown in Table 3. In this case, weights are equally distributed among " Surgery, Hydrogel-based treatment, Hydron therapy, Immunotherapy, and Chemotherapy. The total distribution of weights is one.

**TABLE 4.** Weighted normalized decision matrix

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemotherapy | 0.024 | 0.051 | 0.045 | 0.000 | 0.027 | 0.013 | 0.013 | 0.059 | 0.019 | 0.069 |
| Radiation therapy | 0.022 | 0.058 | 0.043 | 0.000 | 0.048 | 0.030 | 0.035 | 0.048 | 0.075 | 0.020 |
| Surgery | 0.056 | 0.016 | 0.029 | 0.058 | 0.049 | 0.051 | 0.048 | 0.035 | 0.017 | 0.011 |
| Hydrogel-based therapy | 0.065 | 0.021 | 0.041 | 0.051 | 0.047 | 0.047 | 0.047 | 0.017 | 0.025 | 0.016 |
| Hydron therapy | 0.032 | 0.038 | 0.051 | 0.063 | 0.039 | 0.053 | 0.052 | 0.025 | 0.049 | 0.017 |
| Immunotherapy | 0.017 | 0.041 | 0.027 | 0.000 | 0.028 | 0.034 | 0.033 | 0.043 | 0.024 | 0.062 |

Table 4 shows the weighted normalized matrix of the decision matrix and it is calculated by table 2 and table 3.

**TABLE 5.** Positive Matrix

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemotherapy | 0.065 | 0.058 | 0.051 | 0.063 | 0.049 | 0.013 | 0.013 | 0.017 | 0.017 | 0.011 |
| Radiation therapy | 0.065 | 0.058 | 0.051 | 0.063 | 0.049 | 0.013 | 0.013 | 0.017 | 0.017 | 0.011 |
| Surgery | 0.065 | 0.058 | 0.051 | 0.063 | 0.049 | 0.013 | 0.013 | 0.017 | 0.017 | 0.011 |
| Hydrogel-based therapy | 0.065 | 0.058 | 0.051 | 0.063 | 0.049 | 0.013 | 0.013 | 0.017 | 0.017 | 0.011 |
| Hydron therapy | 0.065 | 0.058 | 0.051 | 0.063 | 0.049 | 0.013 | 0.013 | 0.017 | 0.017 | 0.011 |
| Immunotherapy | 0.065 | 0.058 | 0.051 | 0.063 | 0.049 | 0.013 | 0.013 | 0.017 | 0.017 | 0.011 |

Table 5 shows the positive matrix calculated by using table 4. The ideal best for a column is the maximum value of that column in table 4.

**TABLE 6.** Negative matrix

| | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| Chemotherapy | 0.01 | 0.016 | 0.027 | 0.000 | 0.027 | 0.053 | 0.052 | 0.059 | 0.075 | 0.069 |
| Radiation therapy | 0.01 | 0.016 | 0.027 | 0.000 | 0.027 | 0.053 | 0.052 | 0.059 | 0.075 | 0.069 |
| Surgery | 0.01 | 0.016 | 0.027 | 0.000 | 0.027 | 0.053 | 0.052 | 0.059 | 0.075 | 0.069 |
| Hydrogel-based therapy | 0.01 | 0.016 | 0.027 | 0.000 | 0.027 | 0.053 | 0.052 | 0.059 | 0.075 | 0.069 |
| Hydron therapy | 0.01 | 0.016 | 0.027 | 0.000 | 0.027 | 0.053 | 0.052 | 0.059 | 0.075 | 0.069 |
| Immunotherapy | 0.01 | 0.016 | 0.076 | 0.000 | 0.027 | 0.053 | 0.052 | 0.059 | 0.075 | 0.091 |

Table 6 shows the negative matrix calculated by using table 4. The Ideal best for a column is the minimum value in that column in table 4.

**TABLE 7.** SI Plus and Si negative

| | SI Plus | Si Negative | Ci |
|---|---|---|---|
| Chemotherapy | 0.084304 | 0.0723 | 0.461688 |
| Radiation therapy | 0.086428 | 0.0593 | 0.406911 |
| Surgery | 0.071458 | 0.08124 | 0.53202 |
| Hydrogel-based therapy | 0.063215 | 0.08209 | 0.564966 |
| Hydron therapy | 0.070137 | 0.07791 | 0.526255 |
| Immunotherapy | 0.09547 | 0.03924 | 0.291278 |

Table 7 shows the “Si plus and Si negative values”. The difference between each response from the “ideal best” is Found utilizing equation and the difference between each response from the “ideal worst” is found utilizing equation seeing table 4. Table 7 demonstrates the value of Ci. It is calculated by using equation 7. Here Closeness coefficient value for Chemotherapy is 0.461688, Radiation therapy is 0.406911, Surgery is 0.53202, Hydrogel-based therapy is 0.564966, Hydron therapy is 0.526255 and Immunotherapy is 0.291278.

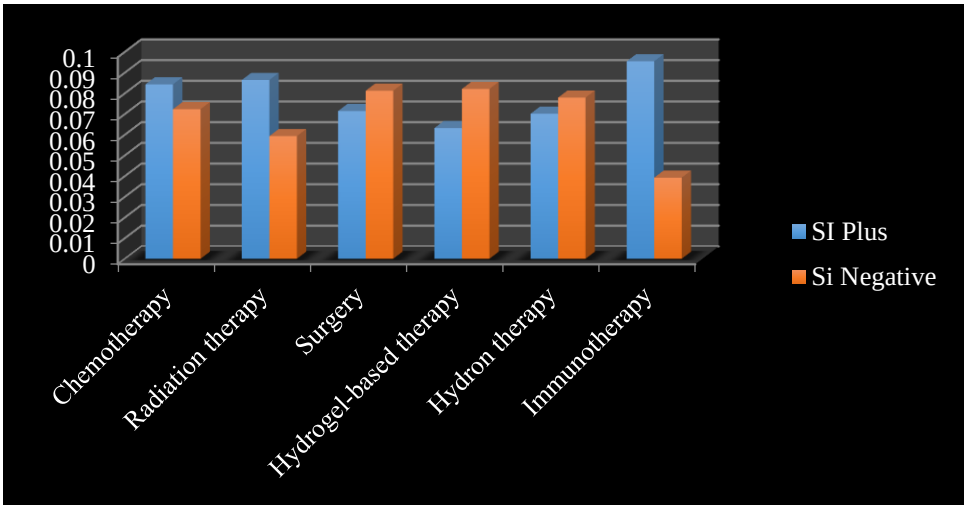


**FIGURE 3.** SI Plus and Si negative

The figure illustrates the "Si plus and Si negative values" from the analysis. The difference between each response from the "ideal best ()" is found utilizing equation 5 and the difference between each response from the "ideal worst (" is found utilizing equation 6.

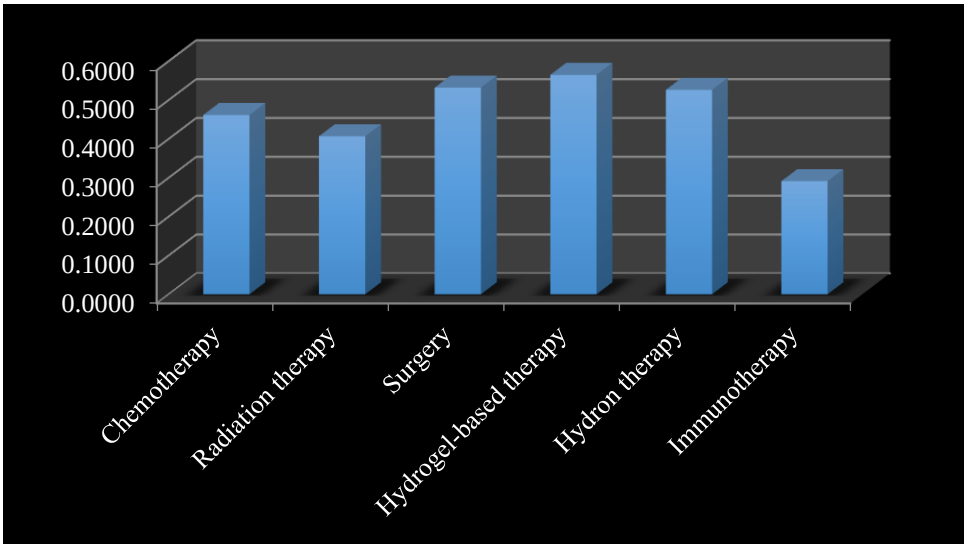


**FIGURE 4.** Closeness Coefficient (CCi)

Figure 3 illustrates the graphical representation of CCi. It is calculated by using equation 7. Here Closeness coefficient value for Thermal is 0.6061, Electrochemical is 0.5199, Thermochemical is 0.4286, Photochemical is 0.2705 and Plasma is 0.6655.

**TABLE 8.** Ranking

| | |
|---|---|
| Chemotherapy | **4** |
| Radiation therapy | **5** |
| Surgery | **2** |
| Hydrogel-based therapy | **1** |
| Hydron therapy | **3** |
| Immunotherapy | **6** |

Table 9 shows the analysis of the Assessment of H2S Production Methods. Here rank of Hydrogel-based therapy is first rank, Surgery is second rank, Hydron therapy is third rank, Chemotherapy is fourth rank, Radiation therapy is fifth rank,and Immunotherapy is sixth rank.

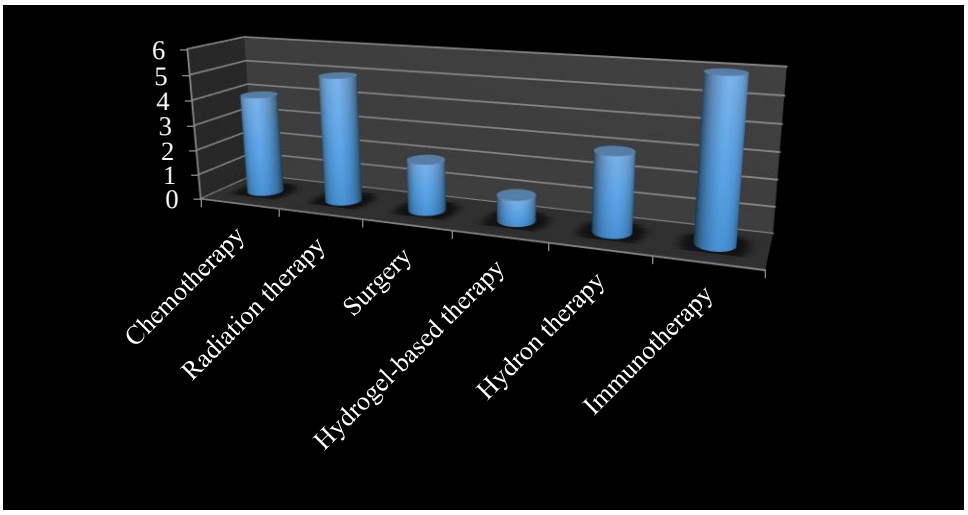


**FIGURE 5.** Ranking

Figure 5 illustrates the ranking of Ui from Table 9. Here rank of alternatives using the TOPSIS method for Here rank of Hydrogel-based therapy is first rank, Surgery is second rank, Hydron therapy is third rank, Chemotherapy is fourth rank, Radiation therapy is fifth rank, and Immunotherapy is sixth rank. The result of the analysis shows that Surgery is selected as the best therapy and Immunotherapy is dancer therapy.

## 5. CONCLUSION

This study uses the TOPSIS method, a tried-and-true decision-making tool, to determine the best ways to treat cancer diseases, which are the leading cause of death worldwide. The findings of this study point to hydrogel-based drug delivery nanoparticles as the most advantageous type of cancer therapy for the management of patient-specific cancer diseases, followed by surgery. Chemotherapy is the option that is listed last. This research benefits both cancer individuals and medical professionals by identifying the most efficient course of action and its specific characteristics. This study also shows that the logical algorithms may be incorporated successfully in offering responses for medical care managers who are interacting with ambiguity issues and that it may be improved in the accessibility of more choices, and criteria, as well as by assigning heavy items of importance to criteria based on every one patient's unique requirements interacting with cancer.

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